PATENT SPECIFICATION (11) 1 329 177

DRAWINGS ATTACHED

1 329 177

(21) Application No. 21981/71 (22) Filed 19 April 1971

(31) Convention Application No. P20 07 033.1

(32) Filed 17 Feb. 1970 in

(33) Germany (DT)

(44) Complete Specification published 5 Sept. 1973

(51) International Classification F28F 3/00

(52) Index at acceptance

F4S 4E 4G

(19)

(54) PLATE HEAT EXCHANGERS

(71) We, FARBWERKE HOECHST AKTIENGESELLSCHAFT, vormals Meister Lucius & Brüning, a Body Corporate recognised under German Law, of 6230 Frankfurt (M) 80 Hoechst, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to plate heat exchangers.

In order to effect heat exchange, which is necessary in industry in a great number of different chemical processes, various types of apparatus have been proposed, *inter alia* so-called plate heat exchangers. The hitherto proposed plate heat exchangers are made of corrosion resistant metallic materials of high quality.

It has been proposed to use polytetrafluoroethylene as material for the manufacture of heat exchangers to be used in aggressive and corrosive mediums, c.f., for example U.S. Patents Nos. 3,228,456; 3,277,959; and 3,315,740. These hitherto proposed heat exchangers comprise tubes of polytetrafluoroethylene or materials containing polytetrafluoroethylene.

The present invention provides a plate heat exchanger including two outer flat sheets in spaced, parallel relationship, the inner face of each sheet being provided with one or more grooves, one or more intermediate flat sheets disposed between and parallel to the outer sheets, each face of the or each intermediate sheet being provided with one or more grooves, and a separating plate sandwiched between adjacent sheets and forming with the grooves ducts contained in parallel planes, the sheets and separating plates being provided with bores through their thickness interconnecting the ducts in alternate planes.

Two forms of plate heat exchanger according to the present invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 shows a top view of a sheet of one form of heat exchanger according to the invention and three sectional views along lines a—a, b—b and c—c, of the heat exchanger.

Fig. 2 shows a top view of a sheet of another form of heat exchanger according to the invention and three sectional views along lines d—d, e—e and f—f, of the heat exchanger.

Fig. 3 shows a top view of a tube connection in a heat exchanger according to the present invention, and

Fig. 4 shows a cross sectional view of the tube connection shown in Fig. 3.

The ducts in alternate planes may be connected in series as is shown in section b—b of Fig. 1, or in parallel as is shown in section e—e of Fig. 2.

Referring generally to the drawings, the heat exchanger comprises a pack comprising a sheet 1 made of polytetrafluoroethylene having meandering grooves on both sides, sheets 2 made of polytetrafluoroethylene having meandering grooves on one side only and positioned on either side of the sheet 1, and polytetrafluoroethylene plates 3 clamped between the sheets 1 and 2 through which plates the heat exchange takes place. The pack of plates and sheets is held together by means of two terminal steel plates 4 and corresponding tie rods 5. In the terminal plates two apertures 6 and 7 are provided for connection sockets 9/10 for the inlet and outlet of the heat giving and heat-receiving media.

The sectional views show the ribs between adjacent grooves exactly one on top of the other (i.e. the grooves are in register) so that the separating sheet may resist, if necessary, as high as possible a differential pressure of the two media. As the ducts may be fed in series or in parallel, the plate heat exchanger may easily be adapted to widely different conditions of quantity and operation, for example, the heat exchange

[*Price 25p*]

of liquid mediums, the condensation of vapours, or vaporization processes.

Referring to Figs. 3 and 4, the connection sockets 9/10 are pressed by means of divided rings 11/12, against polytetrafluoroethylene plates 8, which are provided with distribution channels.

The plate heat exchangers according to the invention may be manufactured from a variety of materials or material combinations, depending on the chemical or thermal stresses to be encountered in use.

Besides pure polytetrafluoroethylene, which has a low coefficient of thermal conductivity and a poor pressure resistance, there may be used co-polymers of tetrafluoroethylene or of polytetrafluoroethylene with other materials which have higher coefficients of thermal conductivity and withstand elevated pressures. Homo- and co-polymers of tetrafluoroethylene used preferably contain a filler, for example graphite. In certain cases, the plate and sheets of the heat exchanger may be manufactured completely or partially from other materials, for example ceramics, in which case the separating plates may be of metals or carbon.

WHAT WE CLAIM IS:—

1. A plate heat exchanger including two outer flat sheets in spaced, parallel relationship, the inner face of each sheet being provided with one or more grooves, one or more intermediate flat sheets disposed between and parallel to the outer sheets, each face of the or each intermediate sheet being provided with one or more grooves, and a separating plate sandwiched between adjacent sheets and forming with the grooves ducts contained in parallel planes, the sheets and separating plates being provided with bores through their thickness interconnecting the ducts in alternate planes.

2. A plate heat exchanger as claimed in claim 1 wherein the ducts in alternate planes are interconnected in series.

3. A plate heat exchanger as claimed in claim 1 wherein the ducts in alternate planes are interconnected in parallel.

4. A plate heat exchanger as claimed in any one of claims 1 to 3 wherein the grooves on either side of a separating plate are in register.

5. A plate heat exchanger as claimed in any one of claims 1 to 4 wherein each sheet is provided with meandering grooves.

6. A plate heat exchanger as claimed in any one of claims 1 to 5 wherein the sheets and separating plates are made of a homo- or copolymer of tetrafluoroethylene or of a material containing polytetrafluoroethylene.

7. A plate heat exchanger as claimed in claim 6 wherein the homo- or copolymer of tetrafluoroethylene contains a filler.

8. A plate heat exchanger as claimed in claim 7, wherein the filler is graphite.

9. A plate heat exchanger as claimed in claim 1 substantially as described herein with reference to and as illustrated in the accompanying drawings.

10. Apparatus which includes a plate heat exchanger as claimed in any one of claims 1 to 9.

ABEL & IMRAY,
Chartered Patent Agents,
Northumberland House,
303—306 High Holborn,
London, WC1V 7LH.

Printed for Her Majesty's Stationery Office by Burgess & Son (Aingdon), Ltd.—1973.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1329177 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

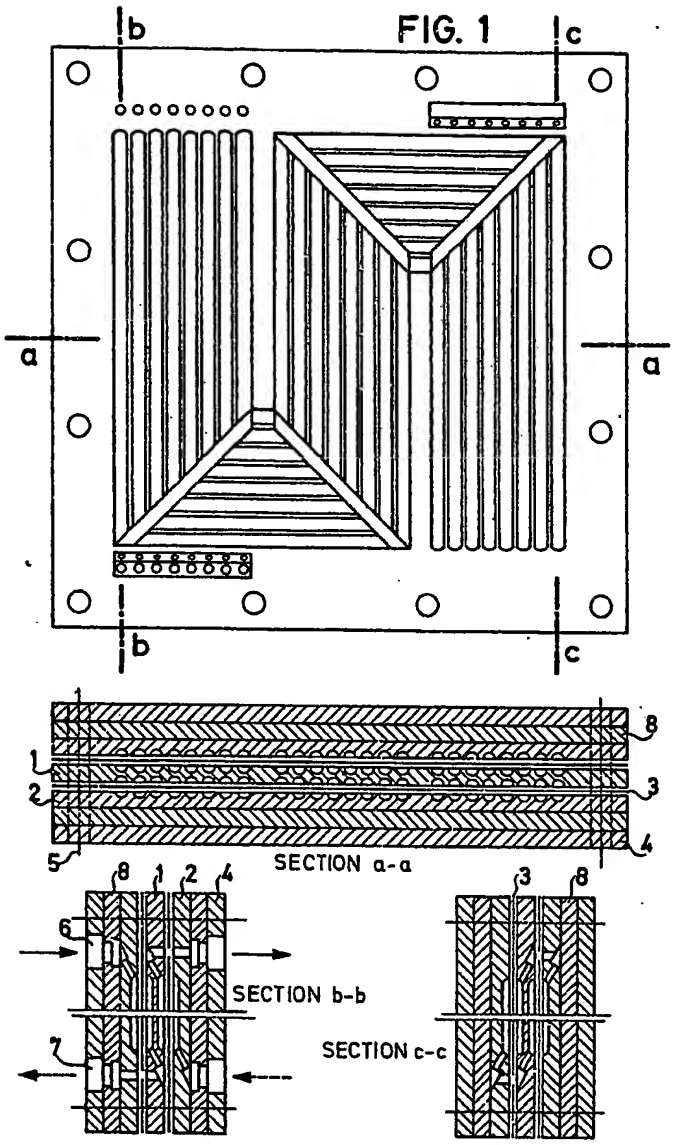
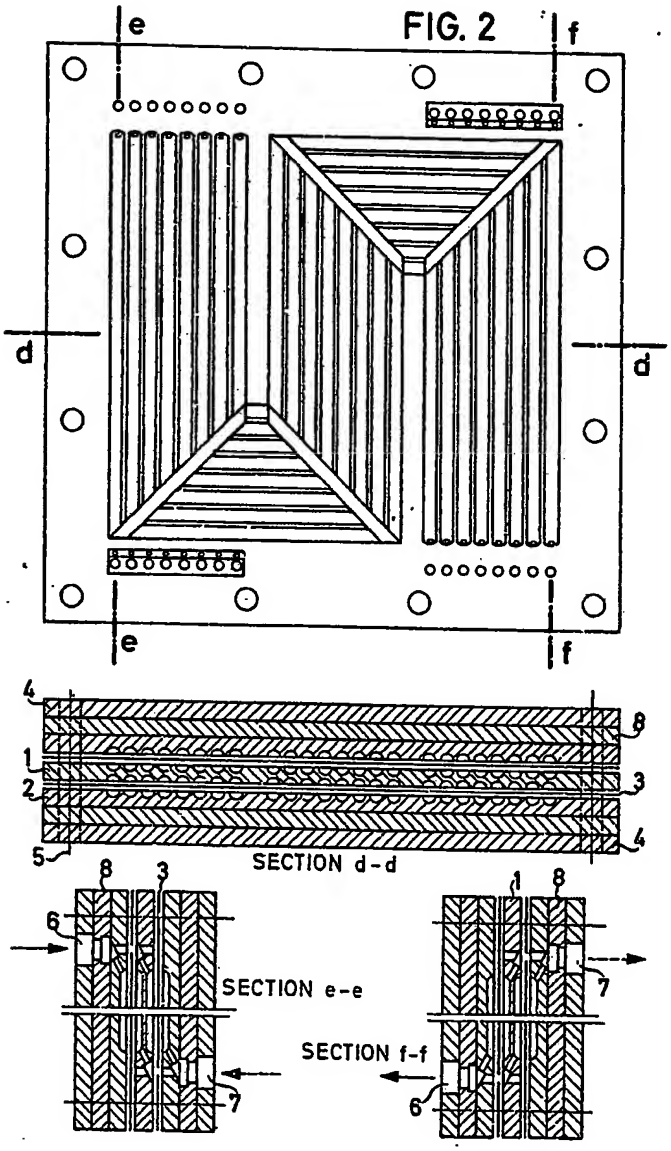


FIG. 2



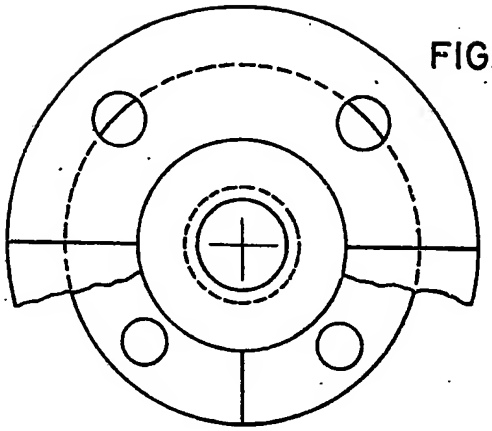


FIG. 3

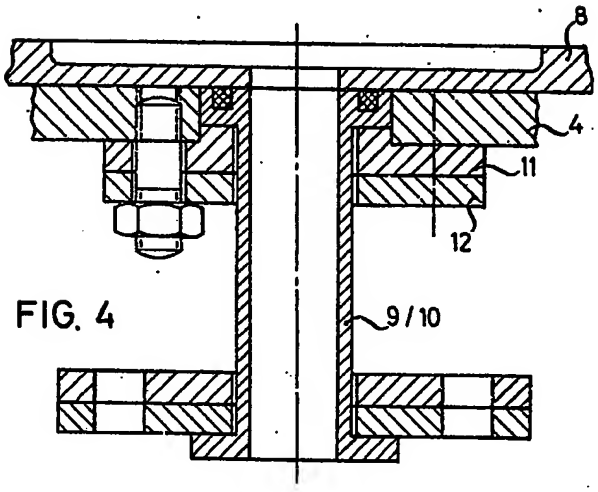


FIG. 4